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Use of Innovative Methods in Forensic Examination

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Annotation: The article examines the features of innovations in modern medicine, highlights the most relevant directions for their development, notes the transformation of the formation of an innovative environment, ensuring the success of innovative activities, and also analyzes the practical application of some innovations and relates the full issues of computerization and robotization of research in forensic practice. The literature review examines questions about modern aspects of the use of innovative methods in forensic medicine.

Key words: forensic medicine, innovative technologies, computed tomography, computerization.

Relevance. Innovation is the result of investment in development and the subsequent process of implementing knowledge that improves operational efficiency. Innovative activity all over the world and in all industries is gaining new momentum and forensic medicine is no exception. Innovation in forensic medicine usually refers to original production technologies - the use of a device or method with a high level of competitiveness in relation to those that already exist [1]. The USA, Germany, Great Britain, Japan, India and China are leaders in the implementation of innovations in forensic medicine; in these countries the amount of scientific research and development is constantly growing, thanks to which forensic medical examination has reached a higher level - identification processes are being successfully improved, quality is improving forensic medical examinations, based on the data of forensic medical examinations, the detection of crimes is increasing. Technologies are being successfully developed that make it possible to identify minimal quantities of objects of various origins, existing ones are being improved, and medical equipment is being introduced, with the help of which forensic examinations can be carried out in the shortest possible time [2]. Every day new opportunities appear and new ways of developing forensic medical examination are opened. The use of new technologies in forensic expert activities has become an integral part of the technological support of their daily activities [3]. One of the large-scale implementations in forensic work is the method of DNA analysis. DNA laboratories are already solving problems that arise in the daily practice of an expert, but for their maximum use, the expert must have special knowledge and have certain skills in working with modern equipment of a new type [4]. Without special training, it is impossible to conduct a full-fledged expert study, since there are significant differences between the use of existing research methods and new technologies introduced into expert activities. The main and uniform requirement for the introduction of modern research methods into the practical activities of any expert branch are methods, the use of which during research will not allow changing the properties and state of the object under study [5]. Since new opportunities for expert research are very important for the court and investigative authorities, and almost every section of the criminal process, in order to clarify the circumstances of the case, needs to be confirmed by

the results of various types of examinations, the issue of constant and regular improvement of the process of conducting forensic medical examinations is important [1 ,3]. Without exaggeration, many innovative areas of development of forensic medicine can be considered technologies of the future. For example, the introduction of a virtual autopsy procedure into the daily practice of forensic experts is very promising and promising, since this method does not require direct physical intervention in the tissue, and, therefore, prevents possible errors associated with the displacement of tissue structures, which is very important when certain circumstances. Images obtained during a virtual autopsy can be stored for a long time and subjected, if necessary, to re-evaluation by experts or if new circumstances of the incident are revealed [6]. Scientific and practical developments and implementation of methods for using computed tomography and 3D imaging technology in the practice of forensic medical research, along with traditional ones, allows not only to qualitatively improve the results of investigative and expert work, but also to obtain maximum information in the shortest possible time [7]. However, sometimes the main barrier to innovative development becomes the person himself with his personal characteristics, the desire to resist to a certain extent everything new and unusual, therefore a necessary condition for moving along the path of innovation in forensic medicine is the formation of an innovation-receptive environment [8]. The creation of infrastructure to support innovation, financing of forensic medicine that implements them, and other economic measures of innovation policy simply need to be accompanied by changes associated with the subjective perception of innovation in society. Computerization and robotization of forensic examination is due to the rapid development of information technology. The specifics of modern manifestations of crime have also significantly transformed, there have been significant changes in its structure - a large place is occupied by the activities of organized, well-equipped groups with a significant material base, which requires an increase in the volume of special knowledge of experts, increased efficiency and expanded scope of their application. Therefore, the objectification of the investigation process is an integral part of the humanization of the criminal process, and the improvement of legal reform is impossible without increasing the role of the significance of physical evidence, their comprehensive and complete use in proof [5]. This is the ultimate goal of introducing the achievements of modern technologies, and above all information, into forensic activities. Problems of automating the process of forensic research arose throughout its development and, at the first opportunity of introducing new research methods into judicial practice, they immediately acquired a noticeable scope, giving more and more accurate and specific results. The need for automation of identification processes carried out in various areas of forensic activity is increasing every day, but at the same time the question of completely replacing experts with modern technology also arises. This question, despite the indisputability of the dominant role of the human expert in analyzing information and drawing up expert conclusions, is always relevant and not only in the field of forensic medicine. However, the means of proof have always been and will be the expert's opinion, while modern technologies make it possible to objectively evaluate the information processed by technology. The results, based on the use of modern methods and obtained in various types of forensic examinations, undoubtedly indicate that the technique differentiates various objects much better than the previously used manual and subjective data based on the perception of an expert. So, in practice, an expert develops methods for solving specific problems, and the operation of computer intelligent systems with a correctly formulated problem allows solving only some of them automatically. An expert, using modern achievements of science and practice, processes data, comes to specific conclusions and is able to evaluate them, while computer systems and modern instruments only help him in this. It should be noted that in the context of the general theory of

decision making, when considering interactive human activity and modern technology, it is customary to assume that the adoption of a specific decision and its assessment is the prerogative of the person responsible for this specific decision and its consequences. New devices only technically support and expand the range of differential identification capabilities of an expert, but decision-making, the formation and evaluation of many alternatives, and the rejection of obviously unsuitable solutions (for example, for reasons of insufficient resources or obviously low criterion assessments) are not available to him. Thus, the result of the introduction of innovations, including computerization and robotization of the process, into forensic activities should be mutual complementarity of each other. The expert sets a goal, formulates problems and solutions, determines general directions of action with the help of computer systems, and intelligent systems make it possible to eliminate or reduce to a minimum subjective human errors and facilitate the performance of various types of auxiliary operations.

Currently, the integration of new information technologies into forensic medicine is proceeding in several main directions. First of all, this is the use of computer technology to automate the collection and processing of experimental data obtained during forensic medical research using chromatography, mass spectrometry, ultraviolet, infrared spectroscopy, X-ray spectral, X-ray diffraction, atomic spectral, molecular genetic and other types of analysis. Such equipment in most cases consists of measuring and computing complexes mounted on the basis of instruments and computers, which allows not only to free the expert from the need to carry out a number of repetitive technically uncomplicated actions, reduce analysis time, increase their accuracy and reliability, but also expand the capabilities of the methods. At the present stage of development of forensic medicine, so-called internal technological databases are used for analysis. These databases contain sets of certain parameters that characterize the conduct of one or another type of examination, since one of the necessary conditions for optimizing the forensic medical examination process and increasing its effectiveness is the complete and timely provision of the forensic expert with all the background information he needs for his work. Another direction of introducing computer technologies into expert activities is information support for expert research. Namely, the creation of databases and automated information retrieval systems for specific objects of examination, which operate mainly on the basis of computer technology and use the computer's capabilities for accumulating, processing and issuing large amounts of information in accordance with the requests. Thus, when conducting a molecular genetic examination of traces of biological origin, the data obtained is used to identify individuals, regardless of the statute of limitations of the crime. These systems make it possible to quickly confirm or exclude the origin of various traces of biological origin from a specific person and enable the expert to fully identify the criminal. Databases available in related fields of science and technology, but adapted to solve forensic problems, are also widely used in expert practice. One of the most promising areas is the introduction of image analysis systems that allow for diagnostic and identification studies (virtual autopsy and forensic reconstructions using 3D scanners). Currently, the main efforts to use modern computer technologies in forensic medicine are concentrated in this direction, which is at the same time one of the most difficult. Another promising area in forensic medicine is the use of information technology in matters that require modeling the processes of committing crimes and solving certain situational problems. Thus, there are various types of basic software modules, on the basis of which you can easily create the necessary systems, filling them with certain content depending on the profile of the examination or the methodology used by the expert. At the same time, the expert does not need special training, since the information he needs is contained directly in the system itself. But the most popular area, requiring intensive development, is the development

and improvement of software systems designed for partial automation of expert tasks, additionally including the direct preparation of an expert opinion.

Currently, the mechanism for conducting forensic examinations includes performing an examination and drawing up an expert opinion in a short time, which is very problematic, especially when conducting complex and voluminous examinations. It should be noted that a constant increase in workload may adversely affect the quality of expert opinions. Automated and specialized systems introduced into the process of conducting forensic medical examinations in these cases solve some of the difficulties that arise. Their use gives the expert the opportunity to correctly and quickly describe, examine, and classify the material evidence provided for forensic medical examination, develop tactics for conducting the examination, allocate research time and competently conduct them in accordance with the methods approved for use, formulate and prepare conclusions. By rationalizing the work of an expert, modern technologies reduce the time required to conduct examinations and significantly facilitate the expert's daily work, allowing him to concentrate on the intellectual aspects of the examination. Thus, modern forensic medicine has several development paths and many new opportunities for its development and improvement, but the choice of path largely depends on the choice of experts and their readiness to introduce innovations into everyday work.

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